CLAIMS

I CLAIM:

1. A method for transferring circuit elements originally supported by an original substrate to locations on a new substrate, said method comprising steps of:

(a) providing said original substrate with a release member disposed upon a surface of said original substrate, said circuit elements being fabricated on a top surface of said release member;

(b) defining individual elements about said circuit elements, said individual elements preferably having a conical frustum-shaped configuration;

(d) fabricating a first set of electrically conductive contacts on a surface of said individual elements, said first set of electrically conductive contacts being preferably concentrically disposed rings defining space therebetween;

(e) freeing said conical frustum-shaped individual elements by removing said release member;

(f) defining frustum-shaped individual element receptors in said new substrate, said receptors having a bottom surface and sloping side walls, said receptors being sized to receive said conical frustum-shaped individual elements;

(g) fabricating a second set of electrically conductive contacts on said bottom surface, said second set of electrically conductive contacts being concentrically disposed rings defining space therebetween, said second set of electrically conductive contacts arranged so as to match said first set of electrically conductive contacts when one of said frustum-shaped individual elements is received in ne of said frustum-shaped individual element receptors;

(h) applying an electrically conductive substance inside said receptors so as to cover at least the electrically conductive contacts on said bottom surface of said receptors, said electrically conductive substance exhibiting increased

conductivity in a direction normal to said bottom of said receptors;

(i) raising said new substrate to an incline, with one end of said new substrate being higher than an opposite end of said new substrate;

(j) pouring said freed frustum-shaped individual elements onto the higher end of the surface of said new substrate having said receptors and shaking said new substrate so that free frustum-shaped individual elements fall or roll down the inclined new substrate and are received in said receptors and said rings of said first set of electrically conductive contacts being brought into conductive contact with corresponding rings of said second set of electrically conductive contacts by the electrically conductive substance inside said receptors; and

(k) removing unreceived and/or improperly received frustum-shaped individual elements which have fallen or rolled down to said opposite end of the inclined new substrate from said surface of said new substrate.

2. The method of claim 1 further including the steps of:

(l) pouring said the unreceived and/or improperly received frustum-shaped again onto said surface of said new substrate;

(m) repeating said shaking followed by said step of removing until all said receptors are filled with said frustum-shaped

individual elements.

3. The method according to Claim 1, wherein in said step of providing said original substrate, said release member comprises a release layer, a temporary carrier or a release tape.

4. The method according to Claim 1, wherein in said step of shaping said individual elements, said shape of said conical frustum is achieved by a method comprising isotropic etching.

5. The method according to Claim 1, wherein in said step of fabricating said first set of electrically conductive contacts, said rings are made of a metal selected from a group comprising gold, aluminum, and titanium-tungsten.

6. The method according to Claim 1, wherein in said step of providing said new substrate, said new substrate is made of a material selected from a group comprising semiconductor materials, glass, and plastic.

7. The method according to Claim 1, wherein in said step of providing said new substrate, said volume of said receptors is between about 5% to about 10% larger than said volume of said conical frustum-shaped individual elements.

8. The method according to Claim 1, wherein in said step of fabricating said second set of electrically conductive contacts, said electrically conductive contacts are made of a metal selected from a group comprising gold, aluminum, and

titanium-tungsten.

9. The method according to Claim 1, wherein in said step of applying said electrically conductive material, said comprises applying and partially curing a unidirectionally conductive resin.

10. The method according to Claim 8, wherein in said step of applying and partially curing said unidirectionally electrically conductive resin, said resin is applied by a method comprising steps of:

(a) coating said top surface of said new substrate and an inside area of said receptors with said unidirectionally electrically conductive resin; and

(b) removing said electrically conductive resin from said new substrate so that only said bottom surface and said electrically conductive contacts formed thereon remain coated with said unidirectionally electrically conductive resin.

11. The method according to Claim 1, wherein in said step of raising said new substrate, said incline comprises an angle between about 30 degrees and about 60 degrees.

12. The method according to Claim 1, wherein in said step of pouring and shaking of said freed truncated individual elements, said shaking is achieved by applying vibrational or ultrasonic energy to said new substrate.

13. The method according to Claim 1, wherein in said step of removing of said untrapped and/or improperly trapped truncated individual elements, said removing is achieved with a use of motorized mechanical means.

14. The method according to Claim 3, wherein said temporary carrier is attached to said original semiconductor substrate using a removable adhesive, said removable adhesive comprising a wax.

15. The method according to Claim 5, wherein said first set of electrically conductive contacts are fabricated by a method comprising metal deposition by evaporation and/or sputtering followed by etching using a photolithographic mask.

16. The method according to Claim 8, wherein said second set of electrically conductive contacts is fabricated by a method comprising deposition by evaporation and/or sputtering followed by etching using a photolithographic mask.

17. The method according to Claim 9, wherein said unidirectionally conductive resin is a Z-axis epoxy resin.

18. The method according to Claim 1, further comprising a method for monitoring and correcting following said transferring of said individual elements, said method for monitoring and correcting comprising steps of:

(a) applying voltage pulse waveforms to said second set of electrically conductive contacts;

(b) measuring a current pulse generated as a result of said applying of said voltage pulse waveforms; and

(c) repeating said steps of applying of said voltage pulse waveforms and of measuring of said current pulse with each receptor.

19. The method according to Claim 18, further comprising, in case of absence of said current pulse, steps of:

(a) said shaking of said new substrate;

(b) said pouring of freed frustum-shaped elements onto the higher end of the surface of said new substrate circuit elements;

(c) said removing of untrapped and/or improperly trapped conical frustum-shaped individual elements;

(d) said applying of said voltage pulse waveforms;

(e) said measuring of said current pulse; and

(f) repeating said steps (a)-(e) until all said receptors are properly filled with said frustum-shaped individual elements.

20. The method according to Claim 19, wherein in said step of shaking of said freed frustum-shaped individual elements, said shaking is achieved by applying vibrational or ultrasonic energy toward said original substrate.

21. The method according to Claim 20, wherein in said step of removing of said untrapped and/or improperly trapped conical frustum-shaped individual elements, said removing is achieved with a use of motorized mechanical means.